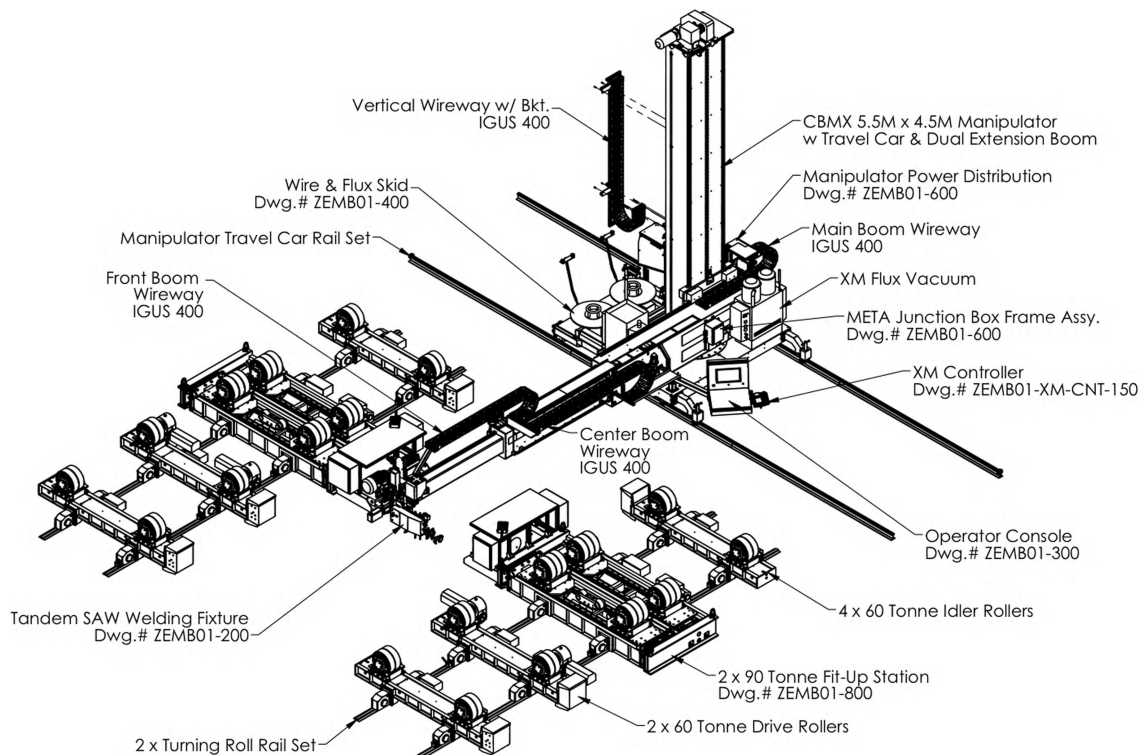


AMET

ADVANCED MANUFACTURING ENGINEERING TECHNOLOGIES

Operation Manual AMET Growing Line System



January 2012

Limited Warranty

AMET Inc. warrants all new equipment to be free from defects in material and workmanship for the period of one year, provided that the equipment is installed and operated according to the instructions.

AMET Inc.'s obligation under this warranty is expressly limited to replacing or repairing any defective part or correcting any manufacturing defect without charge during the warranty period if AMET's inspection confirms the existence of such defects. AMET's option of repair or replacement will be at the F.O.B. factory at Beijing, China, or Rexburg, USA, and therefore no compensation for transportation costs of any kind will be allowed.

The warranty period begins on the date of final acceptance in the final user's facility or three months after shipment.

AMET Inc. will not be liable for any loss or consequential damage or expense accruing directly or indirectly from the use of equipment covered by this warranty.

This warranty supersedes all previous AMET Inc. warranties and is exclusive with no other guarantees or warranties expressed or implied.

Notice

The installation, operation and maintenance guidelines set out in this manual will enable you to maintain the equipment in peak condition and achieve maximum efficiency with your welding operation. Please read these instructions carefully to become aware of every advantage.

 Caution	Only experienced personnel familiar with the operation and safe practice of welding equipment should install and/or use this equipment.
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1 Overall Introduction

The AMET Flange Welding System is an automated tandem Submerged Arc Welding (SAW) station designed to weld longitudinal and circumferential can assemblies both on the inner and outer diameter (Figure 1.1). The system is made up of a telescoping column and boom manipulator mounted on a powered travel cart, which provides mounting and motion of all welding equipment and controls. This special telescoping manipulator has three (3) motions; horizontal telescoping boom travel (7 M), vertical boom travel (5.5 M), and the 20 M Travel Cart. Vertical travel and travel cart motion are commanded from the Manipulator Remote Pendant. Telescoping boom travel is commanded from the XM Controller Joystick. The Can assemblies to be welded are rotated using 60 Tonne driven turning rolls and idlers, and 90 Tonne Fit-Up rollers.

The XM Welding Controller provides programmable control of torch standoff, and cross seam using either manual joystick controls or automatically using the laser tracking system. Turning roll velocity, flux delivery and recovery, and laser standoff and tracking position are all weld program specific. Lincoln Powerwave AC/DC 1000 SD supplies are fully integrated, and controlled via the XM Controller.

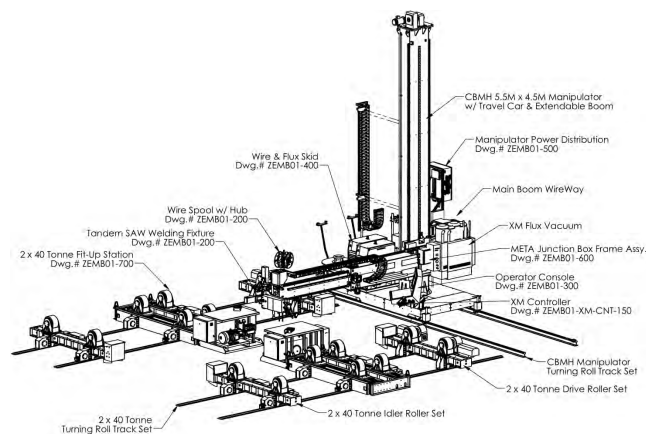


Figure 1.1

1.1 Weld Head

The Weld Head (Figure 1.2) contains the welding contact tips, wire feeders, flux delivery and recovery equipment, laser tracking system, and camera viewing system. The wire feeders are mounted on adjustable plates, allowing for proper contact tip alignment.

Flux is delivered by way of a flux hopper containing a mixture of new and recovered flux. New flux is added to the pressurized feed tank on the travel cart. Leftover flux while welding is vacuumed to the recovery feed tank on the boom, and then delivered back to the weld hopper recovered flux chamber.

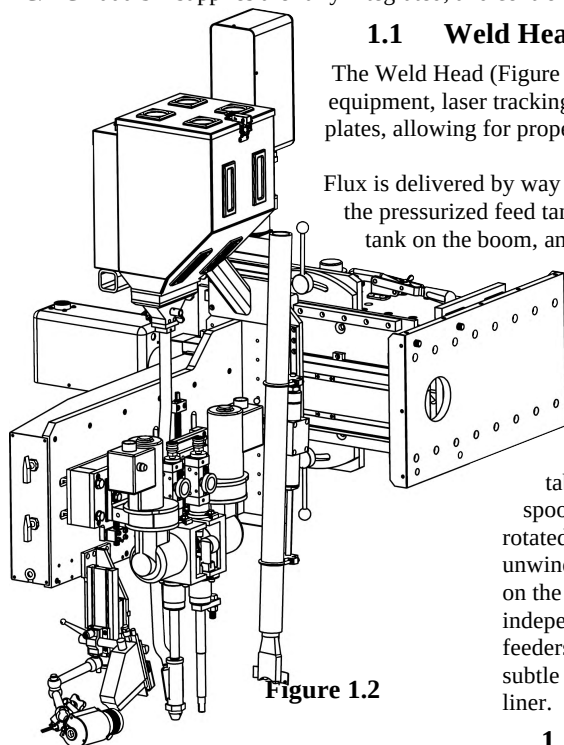


Figure 1.2

1.2 Welding Equipment

The travel cart contains two Lincoln power supplies, new flux pressurized feed tank, and wire wizard bulk spool rotating tables (Figure 1.3).

1000 Kg wire spools are loaded onto pneumatic driven rotating tables. Since the bulk spools are not spooled torsion free, the spool is rotated on a table, to allow the wire to unwind. Pneumatic Feed Assist Motors on the outlet of the bulk spools work independently of the Lincoln power feeders on the weld head, providing a subtle push of the wire through the wire liner.

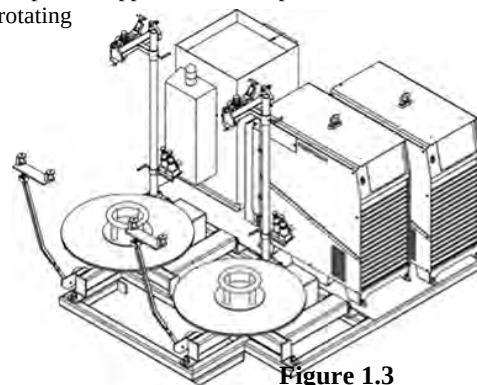


Figure 1.3

1.3 60 Tonne Turning Rolls

Turning Rolls are used to support and rotate parts for circumferential welding. They are paired together as a set consisting of Driven and Idler rollers (Figure 1.4 Items 1, 3). Both distribute the load and support the part, while the driven rollers have servo-controlled motors for precision rotation.

The support wheel assemblies are fixed on a rigid base and the distance between the two rolls can be adjusted by the different mounting holes on the base.

The drive rolls are double driven by two AC variable speed motors with two stage worm gearboxes.

1.4 90 Tonne Fit Up Rolls

Fit Up Rolls (Figure 1.4 Item 2) are used to support and rotate parts for circumferential welding. They are mounted on a single frame, with individual and paired hydraulic controls, for adjusting the centerline, and Can to Can gap between two circumferential parts. The Fit-up Rolls are not driven, and only support the parts, as idlers.

1.5 Pressurized Flux Delivery and Recovery

Flux is supplied by way of two pressurized feed tanks (Figure 1.5). The Primary Pressure Feed Tank provides clean flux. A high capacity vacuum recovers unused flux and recycles it to the flux recovery and feed tank. The weld head flux hopper has two chambers, one for the clean

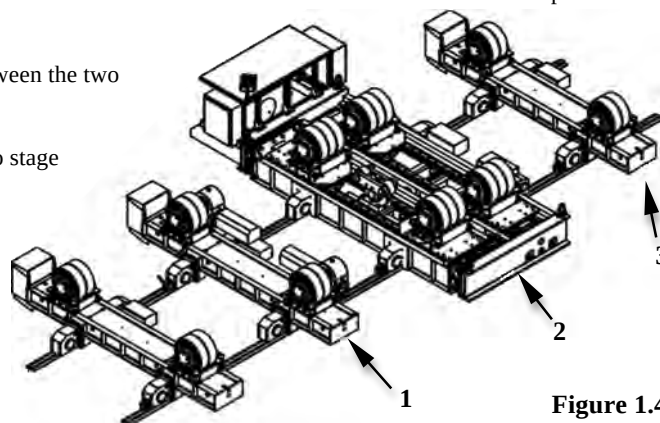


Figure 1.4

flux from the Primary Tank, and one for the recovered flux. A butterfly valve on the outlet, or bottom, of the flux hopper sets the mixture, or ratio, of new to recovered flux.

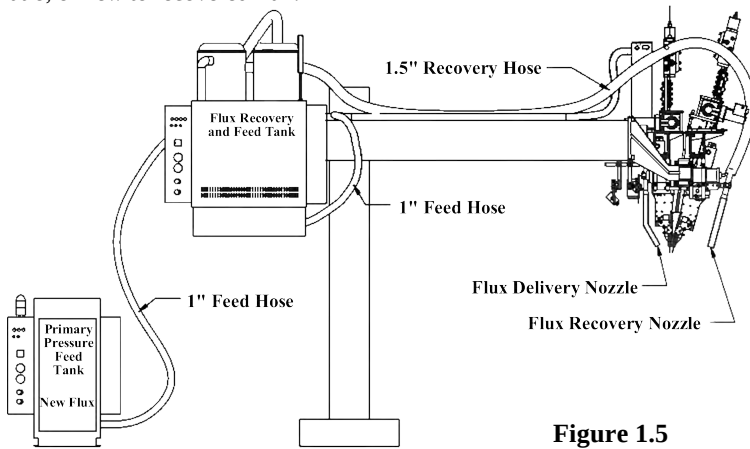


Figure 1.5

The Primary Feed Tank, Recovery Feed Tank, and Weld Hopper all have heater elements to ensure the flux is dry and moisture free. The temperature is adjustable by pressing the up and down arrows, from 0° C to 100° C. Recommended temperature setting is 40° C to 60° C.

2 Specifications

2.1 Physical Specs

2.1.1 CBMX 5.5 x 7 Telescoping Column and Boom Manipulator - Extra Heavy Duty

Specification	Value
Stroke of Boom in Horizontal Motion	23 ft (7000 mm)
Speed Range of Horizontal Motion	2 - 98 in/min (50-2500 mm/min)
Stroke of Boom in Vertical Motion	18 ft (5500 mm)
Speed range of Vertical Motion	7.8 - 78 in (200-2000 mm/min)
Load Capacity	660 lbs (300 kg)
Travel Length of Travel Cart	15.7 ft (4800 mm)
Speed Range of Travel Cart	39 in/min (1000 mm/min)

2.1.2 60 Tonne Turning Rolls

Specification	Value
Load Capacity	66 Ton (60 Tonne)
Drive Capacity	99 Ton (90 Tonne)
Diameter Range	11.8 ~ 216.5 in (300~5500 mm)
Rotation Speed Range	2.9 ~ 49 in/min (75~1250 mm/min)
Weights	
Drive Rolls (Blast Proof)	2 Ton (1.8 Tonne)
Idle Rolls (Blast Proof)	1.8 Ton (1.6 Tonne)
Wheel Housing (Drive)	771 lbs (350 Kg)
Wheel Housing (Idle)	670 lbs (280 Kg)

2.1.3 90 Tonne Fitup Station

Specification	Value
Load Capacity	99 Ton (90 Tonne)
Can Diameter Range	9.8 ft ~ 16.4 ft (3 m ~ 5 m)
Max Rotation Speed	1.2 RPM
Linear Speed	2610 in/min (261mm/min)
Weight/Mass	12.5 Ton (11.3 Tonne)

2.1.4 Automated Flux Delivery and Recovery

2.1.4.1 Flux Delivery: Primary Pressure Feed Tank

Specification	Value
Volume	10.5 gallon/40L
Heater	302F / 150C
Air Pressure	100 psi

2.1.4.2 Flux Recovery: Flux Recovery Vacuum

Specification	Value
Vacuum	4 HP / 3 KW
Volume	10.5 gallon/40L
Heater	302F / 150C
Air Pressure	100 psi

2.2 Electrical Specs

Specification	Value
Input Voltage:	415 VAC
Phase:	3
Max Current:	300 A
Power Rating:	124.5 KwA

3 Major Components

3.1 Extra Heavy Duty Telescoping Column and Boom - CBMX 5.5 x 7

The welding equipment is positioned using a column and boom manipulator, with a special telescoping boom (Figure 3.1). The manipulator is mounted on a motorized travel cart to position the CBMX above either set of 60 Tonne Turning Rolls. The CBMX provides motion to support Inner Diameter (ID) and Outer Diameter (OD) welding on both turning roll lines. A remote pendant is provided for travel cart motion, and the Boom up/down. Boom travel is programmed in the weld programs, and can be jogged from the XM Controller Joystick.

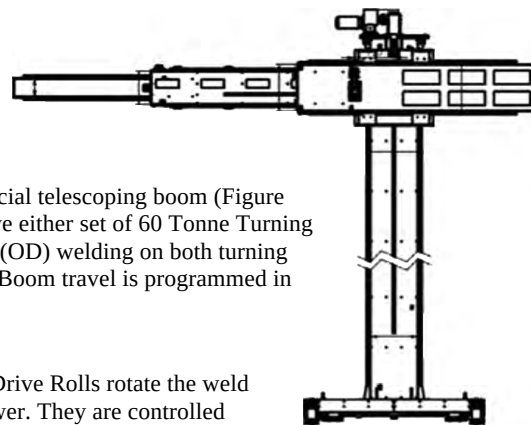


Figure 3.1

3.2 60 Tonne Turning Rolls

Turning rolls are composed of driven and idler wheels (Figure 3.2 Items 1 and 2). The Drive Rolls rotate the weld part by turning the Support Wheels. A motor drive assembly provides the rotational power. They are controlled with either the Standalone 5-Button Pendant or through the XM Controller. The idler rollers are on the outside, and the driven rollers are in the middle. All turning rolls are mounted on driven transverse (bogey) carts. This allows for positioning and adjusting to the different length can assemblies.

3.3 90 Tonne Fit-up Rolls

Fit-Up roll wheels (Figure 3.2 Item 2) are non-motorized, idler style wheels, with one pair of the wheels having 4 inches (100 mm) of transverse travel for butting the cylinders together during fit-up. The Fit-up wheels also have approximately 6 inches (150 mm) of hydraulically powered independent lateral motion for side positioning the cylinder halves correctly in relation to each other.

Fit-up Rolls provide a hydraulic means of aligning two cans, allowing tacking operations. Hydraulic shifting of idler wheels in either independently, or paired motion allows the cans to be shifted side to side, and up and down.

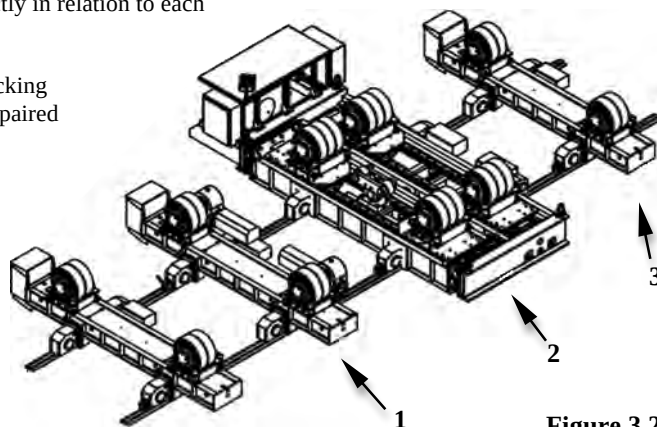


Figure 3.2

3.4 Tandem SAW Weld Head

A 90 degree pivoting weld head (Figure 3.3) provides a mounting frame for a standard Lincoln Tandem SAW package.

Dual Lincoln Power Feeders, wire straighteners, and contact assemblies make up the welding torch package.

Servo-Controlled X and Z precision linear slides provide torch up/down and left/right motion. A META laser tracking package is integrated for standoff and cross seam control. A GigE Ethernet Camera provides remote viewing of the lead torch.

A heated flux hopper, and flux valve delivers new, and recycled flux. An adjustable mix valve sets the percentage of new flux to recycled flux. The flux recovery nozzle is mounted on a pneumatically extending cylinder to automatically retract while not welding.

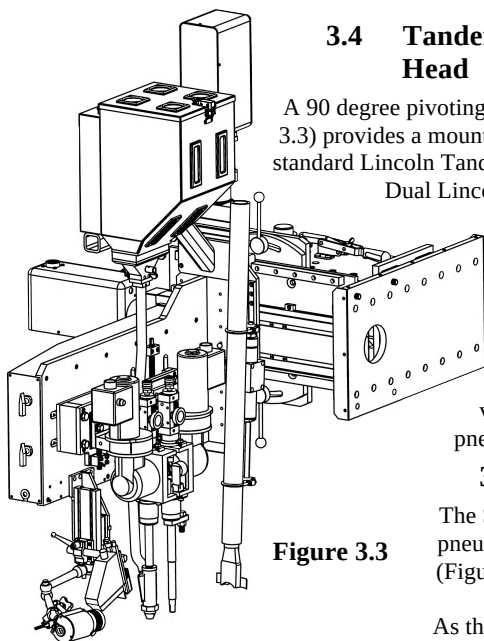


Figure 3.3

3.5 Bulk Wire Feed Delivery

The System is designed for 1000 Kg Bulk Spools of wire requiring pneumatic feed assist motors and pneumatically driven de-spooling tables (Figure 3.4), to aid in pushing the wire the length of the wire liners.

As the Lincoln Power Feeders pull the wire, the wire on the 1000 Kg spool will pull against the bulk spool table sensing arm, lifting it towards the table.

An adjustable limit is reached, actuating the pneumatic rotary motor, de-spooling the wire. The Pneumatic assist motors aid in pushing the wire to the PowerFeeder, reducing the drag from the wire conduit.

A red handled **E-STOP** disconnects air to both the assist feed motor, and the rotary de-spooling table motor. To activate the E-STOP, press it down. **E-STOP** is cleared simply by pulling the E-STOP button out.

3.6 Flux Delivery and Recovery

Flux is supplied via two pressurized feed tanks (Figure 3.5). The Primary Pressure Feed Tank provides new flux. The Flux Recovery and Feed Tank, vacuums used flux and recycles it to the weld head flux hopper. The weld head flux hopper has two chambers, one for the new flux from the Primary Tank and one for the recovered flux. A butterfly valve on the outlet, or bottom, of the flux hopper sets the mixture, or ratio, of new to recovered flux.



Figure 3.4

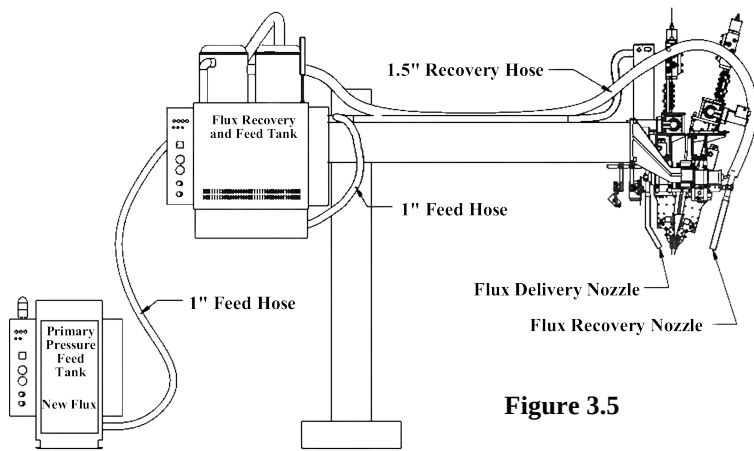


Figure 3.5

The Primary Feed Tank, Recovery Feed Tank, and Weld Hopper all have heater elements to ensure the flux is dry and moisture free. It is adjustable by pressing the up and down arrows from 0° C to 100° C. Recommended temperature setting is 40° C to 60° C.

3.7 Operator Console and XM Weld Controls

The Operator Console (Figure 3.6) provides the central location for the Weld Controls, and Laser and Camera displays. The XM Controller provides joystick controls for the weld head, and is where the weld programs are created and edited. The Controller communicates directly with all control modules located in the electronics and power distribution cabinet. It does this via a standard Controller Area Network (CAN) Bus.

The Laser Display (Figure 3.7) shows the graphical feedback of the laser scan, as well as provides a menu to adjust Laser settings such as Power, Sensitivity, etc. It is mostly used for display purposes, as almost all parameters are set in the weld program on the XM Controller.

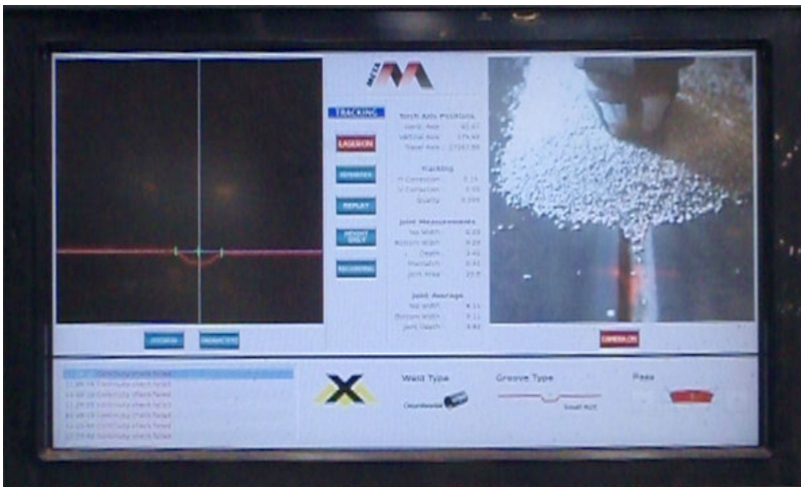


Figure 3.7



Figure 3.6

The Camera Display shows the video feedback from the GigE camera mounted ahead of the weld head, providing remote viewing, mostly used while welding on the OD.

3.8 META Laser System

The Tracking System runs on a Linux configured, embedded computer located inside the Operator Console. The META Computer communicates with the Laser DLS50 Sensor, through the Break Out Board located in the Weld Head Junction Box. It controls the sensor, and receives the optical feedback for image processing.

Image processing displays the actual joint geometry, determines the top and bottom joint positions, and when enabled, calculates the torch programmed position.

4 Setup

4.1 System Startup

4.1.1 Perform Visual Inspection

Prior to system startup, perform a visual inspection of the system:

- 4.1.1.1 Inspect the CBMX Travel Cart Rails for any obstructions to travel cart motion.**
- 4.1.1.2 Inspect the A and B Growing Line Rails for any obstructions to turning roll motion along the rails.**
- 4.1.1.3 Inspect the cable management of the control cables to the turning rolls and fit-up rolls. Ensure they are routed safely away from any obstacles, are not over the rails, and are out of the travel path of the turning rolls and fit-up roll motion.**

4.1.2 Turn System On

Turn on the system by closing, or lifting up on the Main Power Disconnect, located on the wall adjacent to the system. Clear the E-STOP if necessary by ensuring all 4 E-STOP buttons are cleared, or pulled out, and press the “clear E-STOP” soft button on the XM Controller.

4.1.3 Open Shop Air

Open the shop compressed air supply valve, which provides air to the following components:

- 4.1.3.1 Flux Delivery and Recovery Pressurized Feed Tanks.**
- 4.1.3.2 Camera and Laser Sensor cooling.**
- 4.1.3.3 Bulk spool pneumatic feed assist motors and de-spooling tables.**
- 4.1.3.4 Flux recovery pneumatic retract slide.**

4.2 System Shutdown

- 4.2.1.1 Shutdown the system by closing, or pressing down on the Main Power Disconnect, located on the wall adjacent to the system.**
- 4.2.1.2 Close the shop compressed air supply valve located near the Main Power Disconnect.**

5 Controls

5.1 XM Controller

The XM Controller is the central point for integrating and controlling all the weld equipment. It provides the control point for operating and programming the weld equipment. Refer to the XM Software User Manual for more detailed programming information.

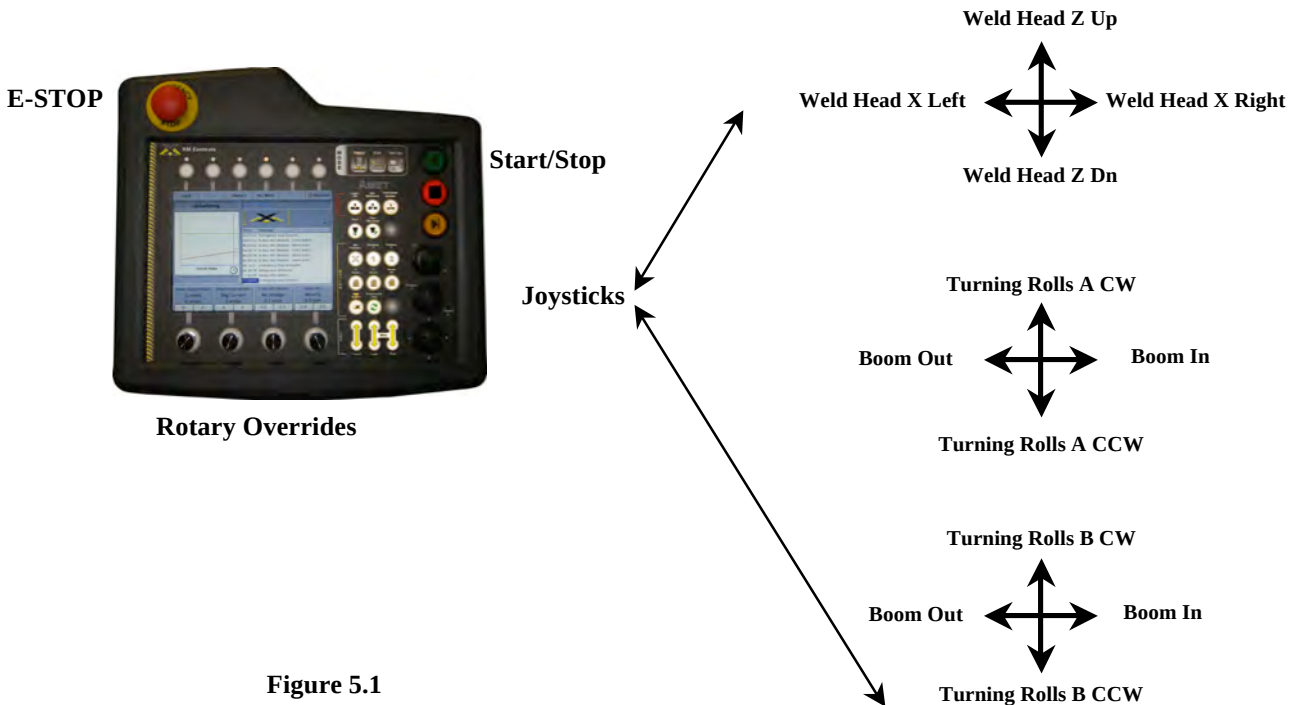


Figure 5.1

E-STOP is used to prevent personnel injury, or equipment damage. The **Start/Stop** buttons are used to begin and end the weld process. The **Rotary Overrides** are used to trim weld parameters within the weld program allowable limits.. The **Joysticks** jog motion axis.

5.2 Standalone Pendants

Hand Pendants are provided for each set of Turning Rolls, Manipulator and Travel Cart. Each Hand Pendant is equipped with an **E-STOP**, and directional enables for motion in 2 directions.

5.2.1 CBMH Pendant (Figure 5.2)

This Pendant controls the Travel Carriage Left / Right, and Column Carriage Up / Dn. To jog, push the directional enable, hold it down for continued motion. When the button is released, motion stops. A mechanical slide interlock prevents jogging both directions simultaneously. When one directional is pushed, a slide mechanism interlocks the other enable, mechanically preventing it from being depressed.

Hi and Lo Speed: Each directional enable is a two position button. Pressing it halfway down enables motion in the Lo Speed. Continuing to press each enable, to its fully depressed position, enables the Hi Speed. Both the Hi Speed and Lo Speed Velocity are set on the Variable Frequency Drive Amplifier located in the CBMH Control Cabinet located on the back of the CBMH Column. For instructions on how to set the Drive velocity, refer to the Fit-up Motor Amplifier Manual in the Support Binder.

E-STOP: E-STOP is used to prevent personnel injury and equipment damage. Upon pressing, all motion, and the welding power supplies are disabled.



Figure 5.2 CBMH Pendant

5.2.2 20 Tonne Turning Rolls Driven Pendant (Figure 5.3)

This Pendant controls the Turning Rolls Rotation, and Transverse Cart (Bogey) jogging.

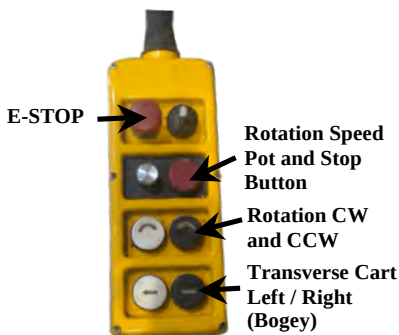


Figure 5.3 TR-D Pendant

Rotation Speed and Direction: The CW and CCW directional enables start rotation when pushed. Rotation speed is set by turning the Speed Pot. CW increases turning roll velocity, CCW decreases.

Note: Turning Roll Rotation continues until the Rotation Stop Button is pressed.

Transverse Cart: The Left and Right directional enables start cart motion when pushed. Motion is stopped when the enable is released.

E-STOP: E-STOP is used to prevent personnel injury and equipment damage. Upon pressing, all motion, and the welding power supplies are disabled.

5.2.3 20 Tonne Turning Rolls Idler Pendant (Figure 5.4)

This Pendant controls the Turning Rolls Transverse Cart (Bogey) jogging.

E-STOP

Transverse Cart Left / Right (Bogey)

Figure 5.4 TR-I Pendant

Transverse Cart: The Left and Right directional enables start cart motion when pushed. Motion is stopped when the enable is released.

E-STOP: E-STOP is used to prevent personnel injury and equipment damage. Upon pressing, all motion, and the welding power supplies are disabled.

5.2.4 Fit-Up Pendant (FRS-40T)

All movement on the Fit-Up Station is controlled with the Fit-Up Pendant (Figure 5.5).

5.2.4.1 Emergency Stop (E-STOP) Button

The E-Stop Button (Figure 5.5 Item 1) immediately cuts power to all motors to stop movement and avoid damage to persons and equipment. To disable E-Stop pull the red “Emergency Stop” Button up.

5.2.4.2 Alignment Wheels

In order to maneuver the weld cans into the correct position for welding, the Alignment Wheels are adjusted to bring the cans flush with one another.

5.2.4.3 Independent Motion

By using the Independent Motion buttons (Figure 5.5 Items 2, 3, 8, 9) only the Support Wheel labeled will move. For example: If Button 5.2. Item 2.UP is pressed Support Wheel A (Figure 5.6 Item A) will travel toward the center of the Fit-Up Station, until the button is released, to bring the can up.

5.2.4.4 Paired Motion

Paired Motion moves both Support Wheels on each half at the same time in the designated direction. For example: If Button 5.5 Item 10.LEFT is pressed Support Wheels C and D (Figure 5.6 Items C & D) will both travel left at the same rate until the button is released.

5.2.4.5 Paired All

The Pair All button (Figure 5.5 Item 6) brings all four (4) Support Wheels to the approximate center of their track. This streamlines the process of changing from a large part to a small part or vice versa.

5.2.4.6 Seam Closure

The Seam Closure buttons (Figure 5.5 Item 7) bring the two halves of the Fit-Up Station closer together or farther apart. For example: If two cans are loaded and need to be brought together, the user may press the Close button (Figure 5.5 Item 7.CLOSE) to butt them against one another.

5.2.4.7 Transverse Drives

The Fit-Up Pendant is can control the movement of transverse drives connected to both the Fit-Up Station as well as a set of idle turning rolls. The Idler (Figure 5.5 Item 12) and Fit –Up Station buttons (Figure 5.5 Item 13) control the movement of the transverse drives indicated. Pressing the FWD button in either section drives the cart toward the manipulator, while pressing REV drives it away from the manipulator.

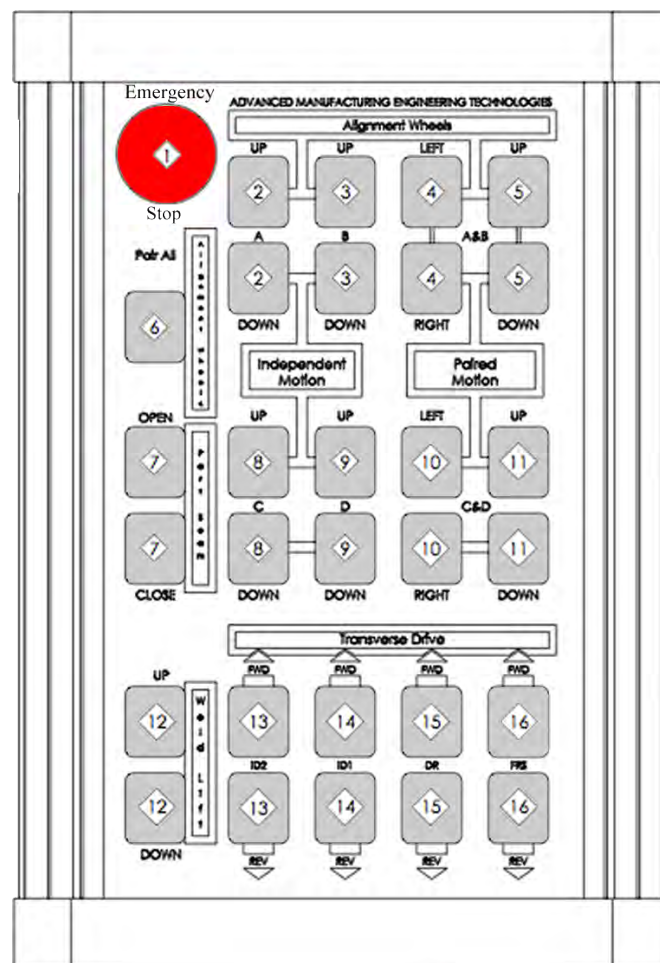


Figure 5.5 90 Tonne Fit-up Pendant

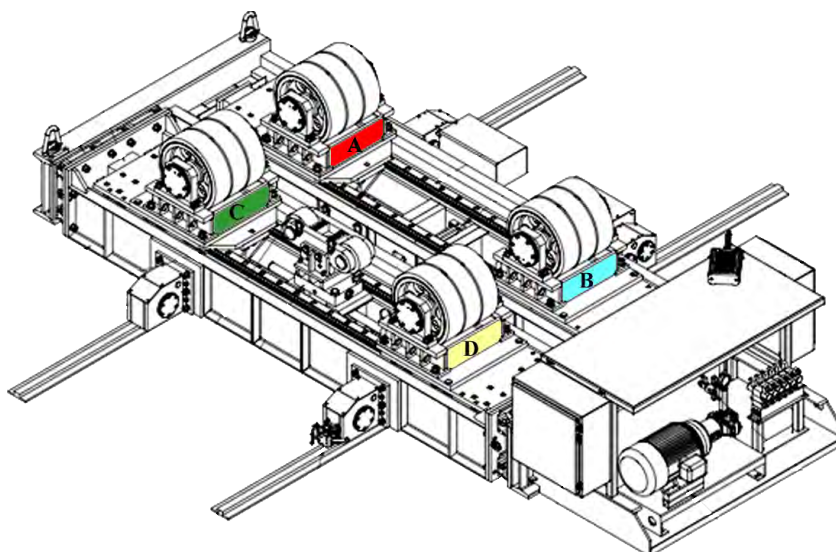


Figure 5.6 Fit-Up Station

5.3 Flux Loading and Feeding

5.3.1 Flux Operation Startup

- 5.3.1.1 Verify Power Switch set to ON.
- 5.3.1.2 Verify indicated pressure on Operating Pressure Gauge. Nominal .4 mPa.
- 5.3.1.3 Verify no low flux alarm light on Primary Feed Tank. (New Flux)
- 5.3.1.4 Press the Conveying button on the Primary Feed Tank, to pressurize both pressurized feed tanks, and begin flowing flux.
- 5.3.1.5 Verify conveying pressure. To ensure feed tank pressure is sufficient for flux to flow, conveying pressure should nominally indicate > .2 mPa.
- 5.3.1.6 Add new flux to the Primary Feed Tank as necessary.

5.3.2 Adding new Flux

- 5.3.2.1 If the conveying light is on, press the conveying button once. This will turn the conveying light off, and begin depressurizing both pressure tanks.
- 5.3.2.2 Once the pressure tanks are depressurized, the pressure tank isolation valves will open. This is visible on top of the Primary Feed Tank.
- 5.3.2.3 Add flux to the top of the Primary Pressure Feed tank screen.
- 5.3.2.4 When done filling, press the conveying button once, to close the isolation valves and pressurize the pressurized feed tanks.

5.3.3 Maintenance

- 5.3.3.1 Periodically open the filter dust drain and empty accumulated filter dust from the bottom of the recovery vacuum chamber. Depending on use, this may be necessary as often as weekly. Doing this will prolong the life of the vacuum filters.
- 5.3.3.2 Periodically open the vacuum filter chamber, and remove and clean the vacuum filters. As the vacuum filters fill, vacuum pressure will drop.

5.3.4 Low Level Alarms

Red Alarms are provided on both pressurized feed tanks, to indicate low levels of flux in the pressure chambers.



Figure 5.7 Flux Loading

5.4 Bulk Wire Loading

5.4.1 New Wire Drum Loading

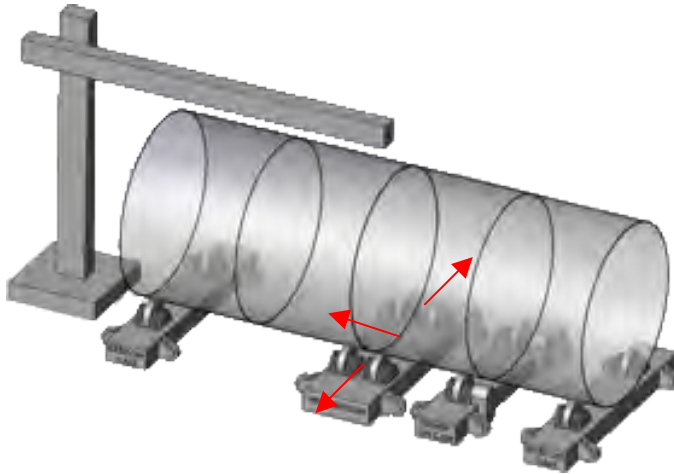
- 5.4.1.1 Press the red handled emergency stop handle.
- 5.4.1.2 Load new wire drum, paying careful attention to centering the drum on the assist table.
- 5.4.1.3 Loop wire through the sensing arm.
- 5.4.1.4 File end of wire until it is smooth, to prevent cutting and scoring of the liners.
- 5.4.1.5 Guide the wire through the assist motors, and through the first liner coupling. Before you proceed, it is recommended to disconnect couplings, contact tips, and loosen the wire tensioner on the weld head wire straightener. These can often be restrictive points in feeding the wire through.
- 5.4.1.6 Pull the red handled E-STOP lever to enable the assist motor, and feed the wire through the liner, and couplings p to the weld head.

5.4.2 Maintenance

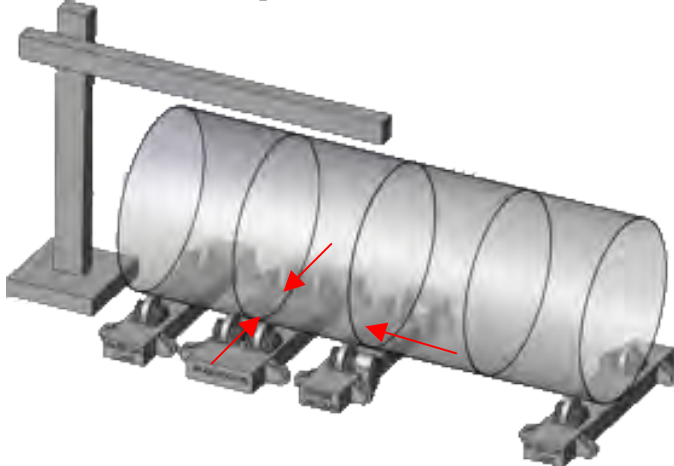
- 5.4.2.1 Periodically inspect the lubricant sight glasses on the assist motor, and table motor. Fill when empty.
- 5.4.2.2 Ensure the sensing arm motion is not restricted.

5.5 Growing Line Tower Progression

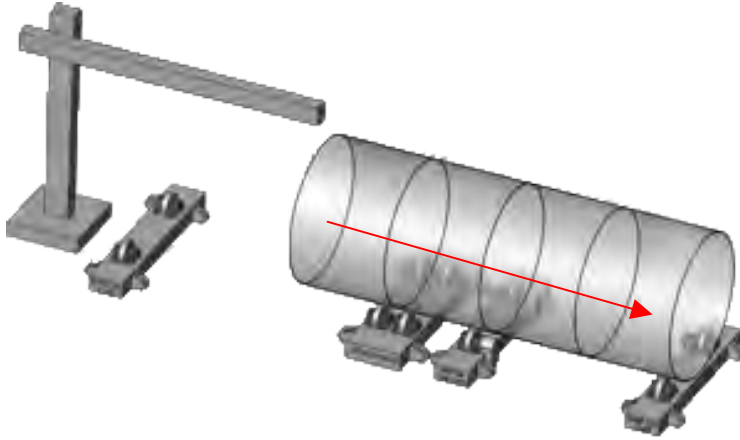
5.5.1 Retract Rollers on Fit-up Station to allow motion toward manipulator end.



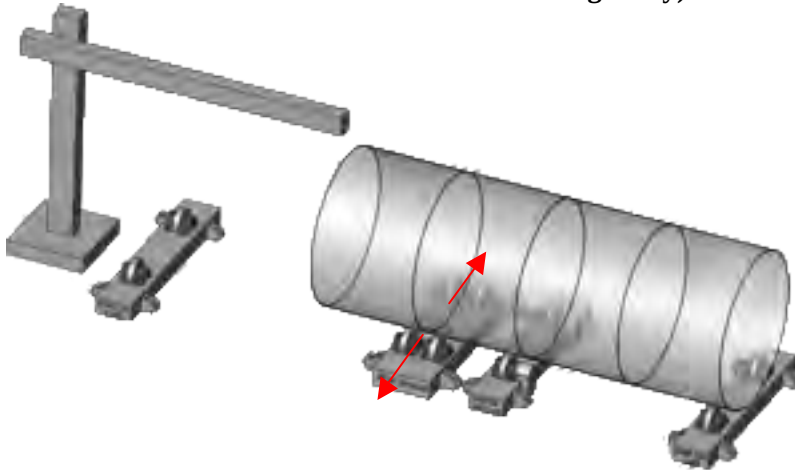
5.5.2 Lift tower with Fit-up Rolls to move driven Rolls.



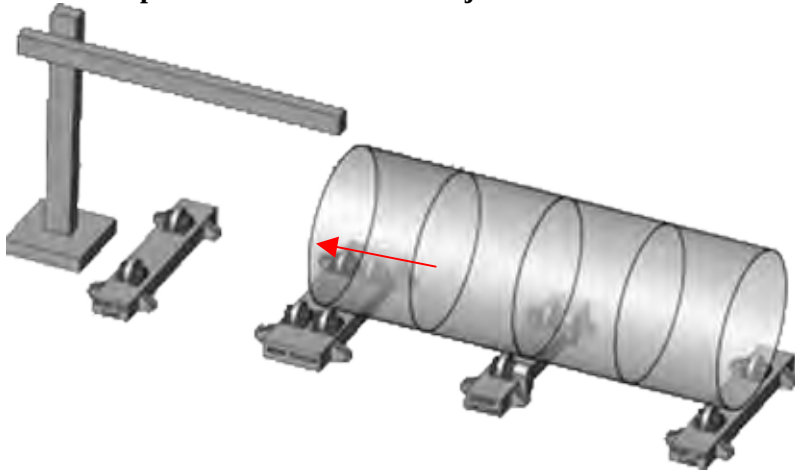
5.5.3 Roll tower down line with transverse drives.



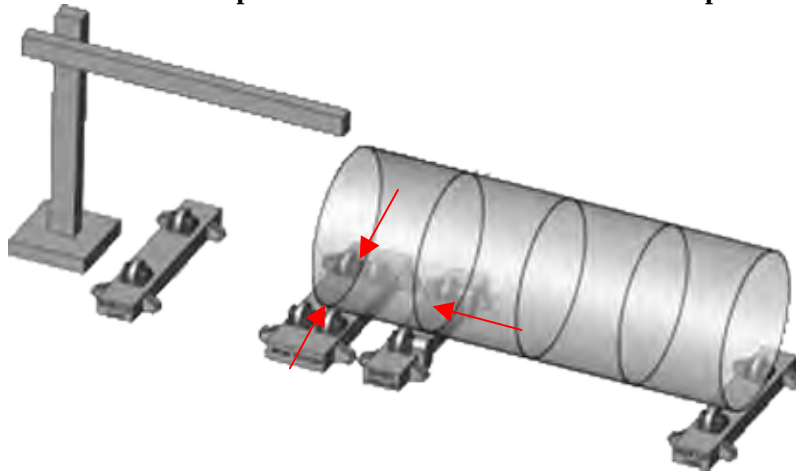
5.5.4 Retract Fit-up rolls and rest tower on driven and idler (crane may be necessary for Steps 5.5.4 and 5.5.5 due to location of the tower center of gravity).



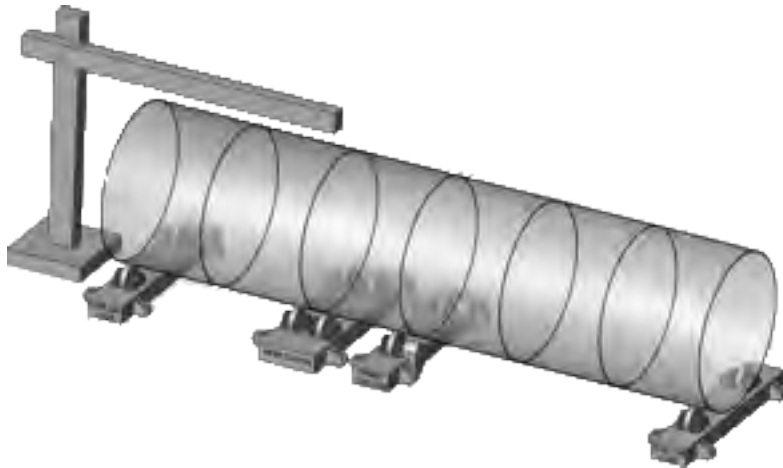
5.5.5 Move Fit-up to end of tower for next joint.



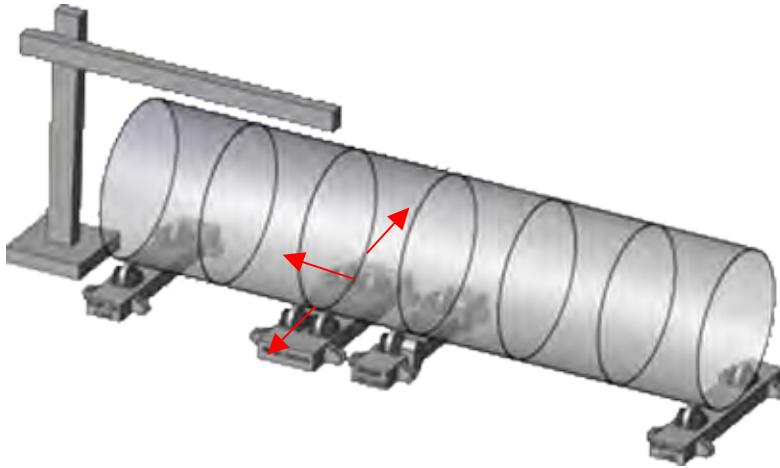
5.5.6 Lift tower on Fit-up Rolls and move driven rolls to Fit-up Station.



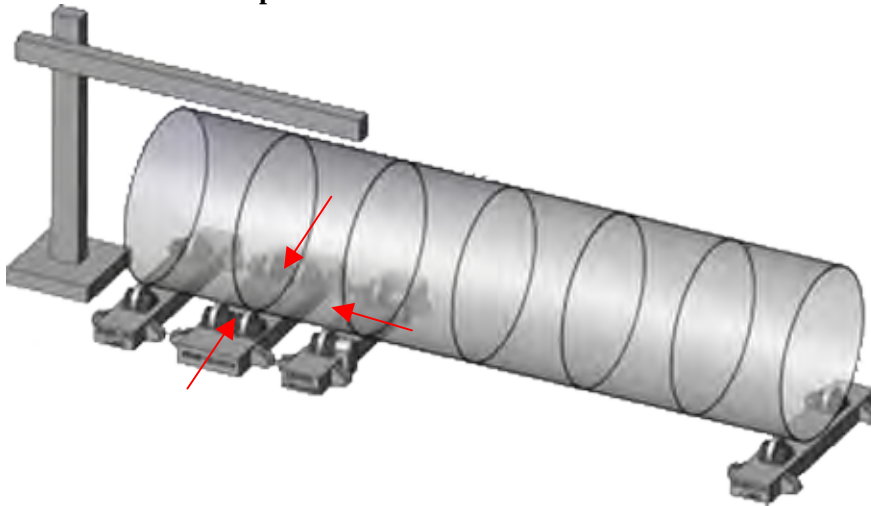
5.5.7 Load and weld next section



5.5.8 Retract rollers on Fit-up Station to allow motion toward manipulator end.



5.5.9 Lift tower with Fit-up rolls and move driven rolls.



5.5.10 Move down line to load next section for welding.

